



**United Nations
Environment
Programme**

**Conference of the Parties to the
Minamata Convention on Mercury
Second meeting**

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Item 5 (c) of the provisional agenda*

**Matters for consideration or action by the Conference of
the Parties: mercury waste, in particular consideration of
relevant thresholds**

**Information submitted by nominated experts that may
contribute to the development of mercury waste thresholds**

Note by the Secretariat

As referred to in the note by the secretariat on the report on the outcome of the open-ended process on waste thresholds called for under article 11 of the Minamata Convention on Mercury (UNEP/MC/COP.2/6), information submitted by nominated experts that may contribute to the development of mercury waste thresholds is set out in the annex to the present note, without formal editing.

* UNEP/MC/COP.2/L

Annex

Information submitted by nominated experts that may contribute to the development of mercury waste thresholds

A. List of mercury compounds

1. A number of experts provided a list of mercury compounds in relation to waste consisting of mercury or mercury compounds. Table 1 presents a list of mercury compounds provided by one expert with supplementary information provided by other experts.

Table 1: list of mercury compounds in use

Compound name	Formula	Common uses
Mercury(II) Perchlorate	Hg(ClO ₄) ₂	Pyrotechnics industry
Mercury(I) Chlorate	Hg(ClO ₃) ₂	Lab reagent
Mercury(II) Oxide	HgO	antiseptic in pharmaceuticals; component of dry cell batteries; pigment and glass modifier; fungicide; preservative in cosmetics; analytical reagent, formerly used in antifouling paints
Mercury(I) Chloride	Hg ₂ Cl ₂	Also known as Calomel (mercurous chloride, Hg ₂ Cl ₂) is used as a standard in <i>electrochemical</i> measurements and historically in medicine as a purgative and teething compound for babies.
Mercury(I) Nitrite	Hg ₂ (NO ₂) ₂	Lab reagent with other mercury compounds.
Mercury(I) Phosphate	(Hg ₂) ₃ (PO ₄) ₂	Pharmaceutical uses, fungicide as ethyl mercury phosphate
Mercury(II) Nitrate Monohydrate	Hg(NO ₃) ₂ H ₂ O	Oxidising agent, lab reagent, historical uses in felt manufacture and detonator production
Mercury(I) Carbonate	Hg ₂ CO ₃	
Mercury(II) Chloride (mercuric chloride)	HgCl ₂	Plastics catalyst for conversion of acetylene to vinyl chloride, historical uses in photography, medicine and biological sample preservation. Rat poison, disinfectant, insecticide. Fungicide as phenyl- and ethyl mercury chloride
Mercury(I) Perchlorate	Hg ₂ (ClO ₄) ₂	reagent
Mercury(I) Nitrate	Hg ₂ (NO ₃) ₂	Oxidising agent, lab reagent, historical uses in felt manufacture
Mercury(II) Nitride	Hg ₃ N ₂	reagent
Mercury(II) Bromate	Hg(BrO ₃) ₂	Lab reagent – can create explosive mixtures
Mercury(II) Acetate	Hg(C ₂ H ₃ O ₂) ₂	a reagent to generate organomercury compounds from unsaturated organic precursors. Phenyl mercury acetate used as fungicide
Mercury(I) Sulfate	Hg ₂ SO ₄	Lab reagent. Used in water sampling to mask chloride interference. Catalyst for the production of acetaldehyde from acetylene and water (as used historically by Chisso Corporation in Minamata)
Mercury(I) Cyanide	Hg ₂ (CN) ₂	Reagent in Koenigs–Knorr reaction for the synthesis of glycosides. Historical use as an antiseptic and in photography. Current use in homeopathy as <i>Hydrargyrum bicyanatum</i>
Mercury(I) Dichromate	Hg ₂ Cr ₂ O ₇	Reagent
Mercury(II) Oxide	Hg ₂ O	Used in pesticide formulations historically
Mercury II Fulminate	Hg ₂ (CNO) ₂	Primary explosive compound historically used in detonators and priming caps.
Mercury Sulphide (cinnabar)	Hg ₂ S	Naturally occurring mineral which is the basis of elemental mercury, also historically used in vermilion pigment

Note: US Environmental Protection Agency's report to the Congress "Potential Export of Mercury Compounds from the United States for Conversion to Elemental Mercury" in 2009, referred to in a comment from an expert, also includes the following compounds

- Mercury(II) Iodide (used in laboratory chemistry, veterinary medicine, nuclear particle detection)
- Mercury (II) Selenide (used in electrochemistry)
- Mercury (II) thiocyanate (used in laboratory chemistry, photography)
- Phenylmercury (II) Acetate
- Thimerosal (Sodium Ethylmercurithiosalicylate, used in pharmaceutical)

Other submissions also included lists of mercury compounds without information on specific use, including US Federal Register 82 FR 49569 (October 26, 2017)

2. One expert noted that the list is only indicative and non-exhaustive, and provided a list of more than 200 mercury compounds taken from the European Chemicals Agency's database.

B. List of mercury added products

3. A number of experts provided lists of mercury added products in use. These are reproduced in Tables 2, 3 and 3 below. Other information provided by experts includes the following:

- US Federal Register 82 FR 49583, Table 2 (October 26, 2017), available at <https://www.gpo.gov/fdsys/pkg/FR-2017-10-26/pdf/2017-23225.pdf>;
- the IMERC mercury products data base, available at <http://www.newmoa.org/prevention/mercury/imerc/Notification/about.cfm>
- Canada mercury product regulations schedule, available at <http://www.gazette.gc.ca/rp-pr/p2/2014/2014-11-19/pdf/g2-14824.pdf#page=176>.

Table 2: Mercury-added products used for the existing purposes under Japanese regulations

1. Primary batteries (limited to: alkaline button batteries, mercury batteries, zinc-air batteries, silver-oxide batteries, manganese dry-cell batteries, and alkaline dry-cell batteries)	11. Hygrometers	29. Boilers (limited to those used in a two phase fluid cycle)	47. Coulometers
2. Standard cells	12. Liquid manometers	30. Rotating lens assembly of a lighthouse	48. Reference electrodes
3. Switches/relays	13. Elastic manometers (limited to diaphragm type)	31. Diffusion pumps	49. Gyrocompasses
4. Fluorescent lamps (including cold cathode fluorescent lamps-CCFL, and external electrode fluorescent lamps-EEFL)	14. Pressure transmitters (limited to diaphragm type)	32. Pressure relief devices	50. Mirrors
5. High-intensity discharge (HID) lamps	15. Vacuum gauges	33. Dampers	51. Grip dynamometers
6. Discharge lamps (excluding fluorescent lamps and HID lamps)	16. Glass thermometers	34. Mercury trim and heel adjusting devices	52. Pharmaceutical products
7. Cosmetic products	17. Mercury-filled pressure thermometers	35. X-ray tubes	53. Polishing agents
8. Agricultural chemicals	18. Mercury clinical thermometers	36. Mercury resistance standards	54. Arts and crafts
9. Pesticide, biocide, topical antiseptics (excluding pharmaceutical products and agricultural chemicals)	19. Mercury sphygmomanometers	37. Rotary connectors	55. Formulation of mercury ¹ (I) chloride
10. Barometers	20. Temperature fixed-point cells	38. Infrared detection elements	56. Formulation of mercury (II) chloride
	21. Rubber	39. Differential pressure flowmeters	57. Formulation of mercury (II) iodide
	22. Pigment	40. Float type densitometers	58. Formulation of mercury (I) nitrate
	23. Perfume	41. Clinometers	59. Formulation of mercury (II) nitrate
	24. Detonators	42. Frequency standards	60. Formulation of mercury (II) thiocyanate
	25. Fireworks	43. Radiation detectors	61. Formulation of phenylmercury (II) acetate
	26. Paints	44. Detector tubes	
	27. Daguerreotypes	45. Elapsed time indicators	
	28. Mercury alloy pellets and powder	46. Strain gauge sensors	

¹ When "formulations" of mercury and mercury compounds listed from No 55 to No 62 are used as reagents, they are considered as mercury-added products only if they are processed (e.g. diluted and mixed) for the specific purpose under the Act on Preventing Environmental Pollution of Mercury.

Table 2: Product types that require recovery of mercury or specific safe disposal measures being considered in the Republic of Korea

- Items for priority management (18 items): for promoting mercury recovery and recycling
1. switches/relays, 2. (thermometer, sphygmomanometers, pressure gauge etc), 3. mercury batteries, 4. fluorescent lamps, 5. dental amalgam, 6. high pressure mercury vapor lamps, 7. (CCFL and EEFL), 8. rotating lens assembly of a lighthouse, 9. mercury trim and heel adjusting devices, 10. differential pressure flow meters, 11. floating type densitometers, 12. clinometers, 13. elapsed time indicators, 14. strain gauge sensors, 15. coulometers, 16. gyrocompasses, 17. grip dynamometers, 18. UV lamps (Short-Arc lamps)
* Cosmetics, pesticides, biocides and topical disinfectants are subject to the Minamata Convention, however, these are excluded from mercury recovery list because they are released to the environment when users used these products with a little content of mercury.
- Items proposed to management in addition (18 items): for mercury treatment and safe disposal
1. HID lamps (high intensity discharge lamps), 2. discharge lamps (except for fluorescent lamps and HID lamps) 3. batteries (except for mercury batteries), 4. pesticide, 5. mercury resistance standards, 6. temperature fixed-point cells, 7. frequency standards, 8. Boilers (limited to those used in a two phase fluid cycle), 9. standard cells, 10. pharmaceuticals, 11. medicine manufactured with mercury, 12. medicine manufactured with mercury (I) chloride, 13. medicine manufactured with mercury (II) chloride, 14. medicine manufactured with mercury (II) iodide, 15. medicine manufactured with mercury (I) nitrate, 16. medicine manufactured with mercury (II) nitrate, 17. medicine manufactured with mercury (II) thiocyanate, 18. medicine manufactured with phenyl mercury (II) acetate

Table 3: List of mercury added products provided from other experts

List 1:

1-Equipment
Lamps (high pressure or fluorescent)
Some WEEE (switches)
Some batteries
Measuring and controlling devices
Distress flares
Airbags
Specific devices/equipment/mechanical pieces with mercury welds
2-Products
Dental amalgam
Some paints
Some cosmetics
Some homeopathic products
Some pesticides, biocides and topical antiseptics
Some catalysts
Some preservatives (vaccines, paints, cosmetics)
Some chemical intermediate

List 2:

Fluorescent Lamps (including Tanning Bed Lamps, CFLs, LFLs)
High pressure mercury vapor lamps
Cold Cathode Fluorescent Lamps (CCFLs)
External Electrode Fluorescent Lamps (EEFL)
Mercury-Containing Switches (Lighting, Refrigerators, Freezers, vehicles, aviation and marine applications)
Mercury-Containing Thermostats
Silent Wall Switches
Commercial/Industrial Heating & Cooling Equipment
Mercury-Containing Float Switches
Mercury-Containing Gas-Fired Devices with Pilot Lights and Flame Sensors (ex. Gas Ranges and Ovens)
Mercury-Containing Manometers/Barometers
Batteries
Cosmetics (skin lightening soaps and skin creams)
Pesticides, biocides, disinfectants and antiseptics
Measuring devices (barometers, hygrometers, thermometers, sphygmomanometers)
Dental amalgam.

C. Data on mercury content in waste contaminated with mercury or mercury compounds

4. One expert submitted information on mercury concentration in different types of waste in Japan. The submitted information is reproduced as Figure 1. Japan has identified that mercury is recovered from wastes contaminated with mercury or mercury compounds whose total mercury concentration is equal to or higher than 1000 ppm (see figure 1). To ensure mercury recovery from such wastes when mercury demand decreases, the Waste Management Act requires mercury recovery from wastes contaminated with mercury or mercury compounds whose total mercury concentration is equal to or higher than 1000 ppm. Mercury is also recovered from some wastes contaminated with mercury or mercury compounds whose mercury concentration is lower than 1000 ppm.

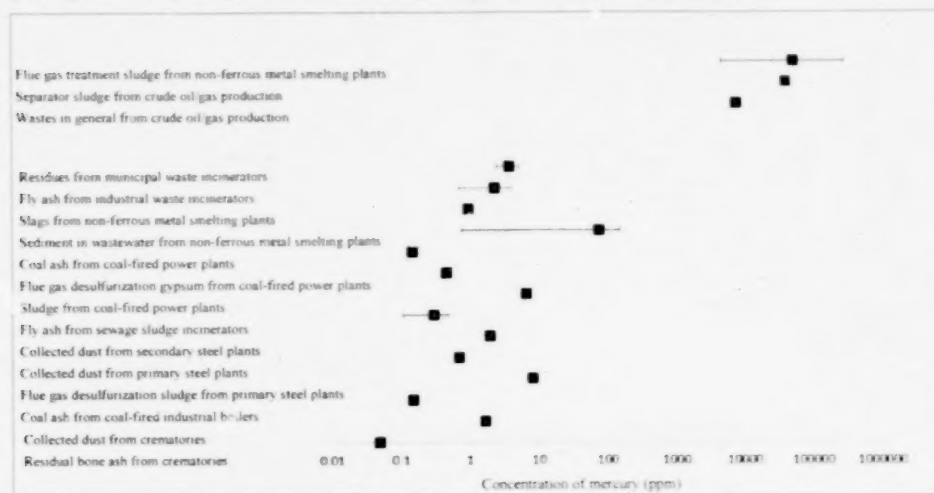


Figure 1: Examples of wastes contaminated with mercury or mercury compounds and their mercury concentrations

Source: Committee on the environmentally sound management of mercury wastes, Working Group on the recovery and disposal of mercury (2014). Report on the environmentally sound management of mercury wastes (in Japanese)

5. One expert submitted information on mercury content of waste in the Republic of Korea.

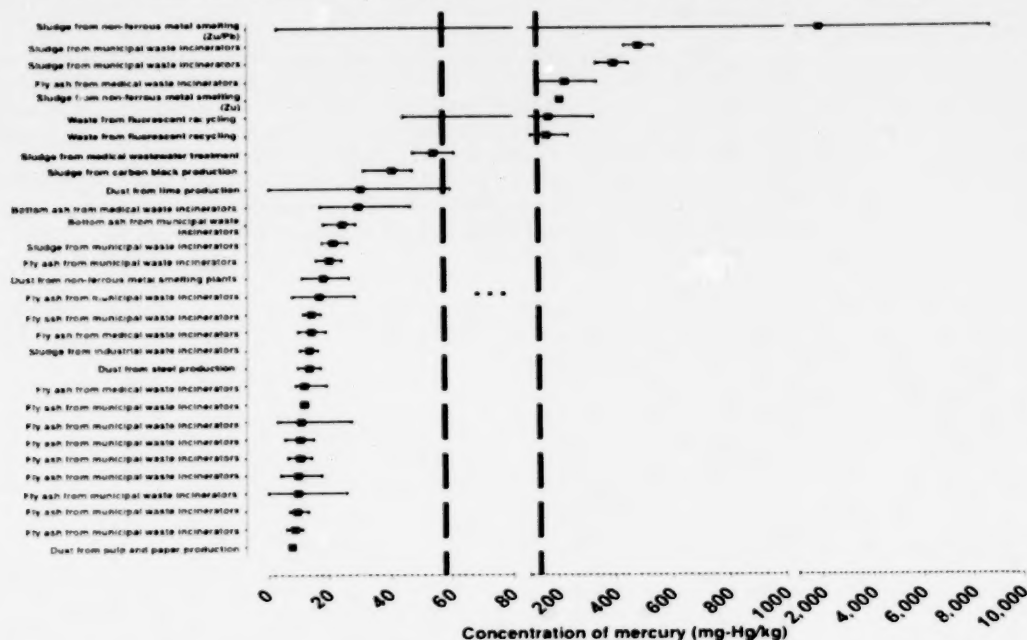


Figure 2: Mercury concentrations of the industrial wastes generated in ROK
(Blue squares are the mean values and error bars are the standard deviations)

6. One expert submitted information from mercury waste inventory in Sweden. As reproduced in Figures 2 and 3, the Swedish data show that for a concentration limit of 1 % mercury (10 000 mg/kg), the amount would equal ~697 tonnes of mercury contained in ~9 800 tonnes of waste (modified from SEPA 2003²). If on the other hand a threshold value of 0.5 % mercury (5000 mg/kg) is applied, the amount would equal ~772 tonnes of mercury in ~23 000 tonnes of waste; and for a threshold value of 0.1 % mercury (1000 mg/kg) the corresponding amounts are 1052 tonnes of mercury in 133 000 tonnes of waste. The numbers are presented in the diagrams below. Figure 2 shows the cumulative amounts of mercury and amount of waste in descending order. The diagram clearly shows that a large fraction of the mercury inventory is contained in the wastes with the highest concentrations. About 97 % of the mercury is found in wastes with a mercury concentration of 1000 mg/kg or higher. From the second diagram it is clear that wastes with a mercury concentration in the range 1000-5000 mg/kg constitutes a significant source of mercury (280 tonnes).

² SEPA (2003): A Safe Mercury Repository. English translation of the Swedish Government Official Report 2001:58 produced by the Swedish Environmental Protection Agency. Report 8105

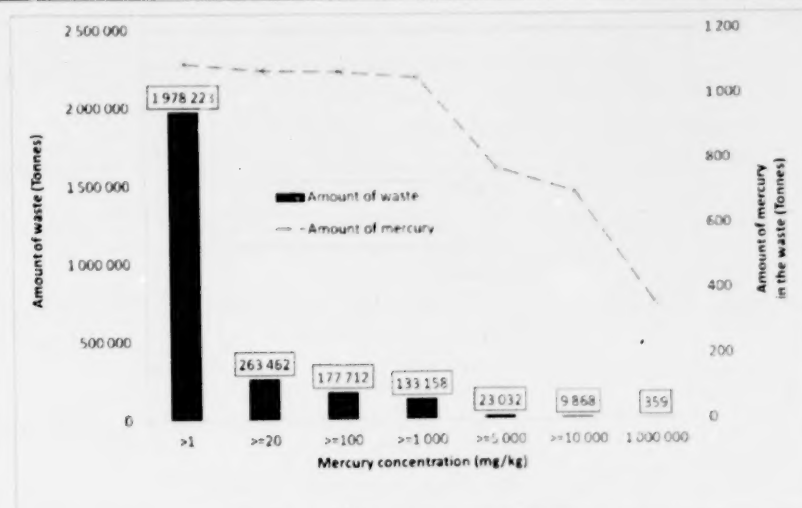


Figure 3: Inventory of Swedish mercury waste (modified from SEPA 1997³). The diagram shows cumulative amounts in descending order

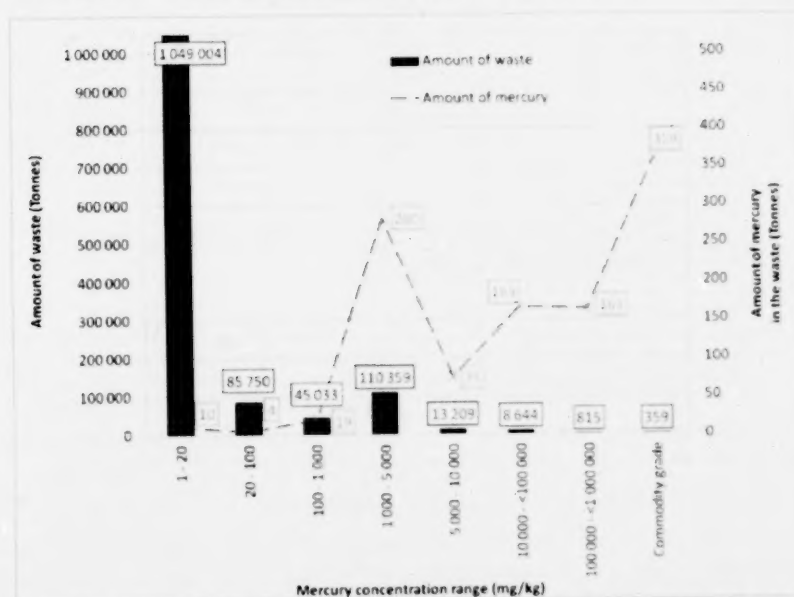


Figure 4: Inventory of Swedish mercury waste (modified from SEPA 1997). The diagram shows the amounts within specific mercury concentration ranges.

7. The previous compilation document included data submitted by experts on mercury concentration in different types of waste in Japan and Sweden. One expert submitted information from a study in the Republic of Korea. Out of 394 samples, eight samples contained over 150 mg/Kg of mercury, and these 2% of wastes took up almost 90% of the mercury release from all of the industrial wastes.

³ SEPA (1997). Final disposal of mercury – Mercury containing waste in Sweden – Inventory, characterization and prioritizing. Karin Pers, Lars Gunnar Karlsson, Lars Olof Höglund, Kemakta Konsult AB, report to Swedish Environmental Protection Agency (SEPA) Rapport 4768 (in Swedish).

D. Existing thresholds in national legislation

8. One expert submitted information on existing mercury thresholds in the waste ordinance in Switzerland⁴ as follows.

Table 5: Mercury waste thresholds in Switzerland

Annex 3 (ref. in article 17)	Requirement for demolition and excavation material (unpolluted)	0.5 mg Mercury / kg dry matter
Annex 3 (ref. in article 17)	Requirement for demolition and excavation material (subject to further use in construction materials)	1 mg Mercury / kg dry matter
Annex 4 (ref. in article 24)	Requirement for waste, used as raw material in cement and concrete production	1 mg Mercury / kg dry matter
	1) Use of waste as raw material and raw mix corrective in cement clinker production	
	2) Use of waste as alternative fuel in cement clinker production	1 mg Mercury / kg dry matter
Annex 5	Requirement for waste put in a landfill	2 mg Mercury / kg dry matter
	1) Type B landfill (inert waste)	0.01 mg Mercury / Litre dry matter (leaching)
	2) Type C landfill (solidified fly ashes of MSWI)	The total content of mercury may not exceed 5 mg / kg dry matter for metal-containing, inorganic and badly soluble waste
	3) Type D landfill (slag of MSWI)	5 mg Mercury / kg dry matter
	4) Type E landfill (other waste, slightly reactive)	5 mg Mercury / kg dry matter

9. One expert provided the following information on the regulations in China.

The method of identifying hazardous waste in China

According to *«Identification standards for hazardous wastes General specifications»* (GB5085.7-2007), the hazardous wastes are those wastes that are listed on national hazardous waste list, or the ones that are identified having one or more hazardous characteristics, including corrosivity, toxicity, flammability, reactivity and infectivity based on national hazardous waste identification criteria and methods, and those solid wastes that could not find proof to prove they had none of above mentioned hazardous characteristics, also might be identified as a hazardous waste.

For the identification of hazardous wastes that containing mercury, leaching toxicity and total content toxic substances are usually used, in addition to the identification of corrosivity, reactivity and flammability.

(1) Identification method of leaching toxicity and the threshold

According to the requirement of the standard methods of *Solid waste- Extraction procedure for leaching toxicity-sulphuric acid and nitric acid method* (HJ T299-2007), preparation methods of the leaching test solution for mercury and other metals are as follows: Prepare the extracting solution by adding the mixture of concentrated sulfuric acid and concentrated nitric acid in a 2:1 ratio (w/w) into reagent water, to adjust the pH value to 3.20±0.05. Weigh the waste samples that going to extract, and calculate the volume of extract required according to a liquid-solid ratio of 10:1. If the total mercury concentration in the leachate does not exceed the threshold limit (0.1mg/L), and no alkyl mercury is detected (i.e. Methyl mercury <10ng/L, ethyl mercury <20ng/L), then the solid waste will be regarded as having no hazardous characteristics of leaching toxicity.

(2) Identification method for total toxic substances and its threshold

According to *Identification standards for hazardous wastes-Identification for toxic substance content* (GB 5085.6-2007), there are five annexes of chemical compounds with different toxicity, in the five annexes, there is only in annex A and Annex B that can find the mercury compound, but none in others. In annex A we can find mercuric iodide, thiocyanate mercury, mercuric chloride, mercuric cyanide and mercury nitrate, etc, and the threshold 0.1% is applies for the total content of above mentioned mercury compound. In annex B, only can found mercurous bromide.

⁴ <https://www.admin.ch/opc/fr/classified-compilation/20141858/index.html>

and the threshold is 3%. For mixtures, the sum of the toxicity of all the components in all annexes is taken into account. If a mercury waste meet any of such three situations, it can be identified as a (mercury) hazardous waste.

4.2 The relevant regulations of mercury content or waste mercury related to waste management and disposal in China

(1) the criteria for entering the municipal solid waste (MSW) landfills

According to *Standard for Pollution Control on the Landfill Site of Municipal Solid Waste (GB18485-2014)*, if the concentration of hazardous ingredients in the leachate obtained according to *The Solid waste – Extraction procedure for leaching toxicity – Acetic acid buffer solution method (HJ/T300-2007)* are lower than the thresholds setting in *GB18485-2014*, municipal solid waste incineration (MSWI) fly ash, medical waste incineration residue, and general industrial solid waste, can be disposed in MSW landfills in a separated space. Among them, the threshold of mercury is 0.05mg/L.

(2) co-processing waste in Cement kiln

Wastes containing mercury are prohibited from being co-processed in cement kilns based on the requirements of *Standard for pollution control on co-processing of solid wastes in Cement kiln (GB30485-2013)*. The solid waste prohibited from entering cement kilns and which is related to mercury waste are as follows:

- (a) spent batteries, used household appliances and electronic devices that are not dismantled;
- (b) Thermometers, sphygmomanometers, fluorescent tubes and switches containing mercury;
- (c) wastes unidentified wastes and with unknown characteristics.

(3) regulation related to identification of Contaminated Soil

According to the requirement of *Identification standards for solid wastes-General rules (GB34330-2017)*, in the activities of contaminated site remediation and disposal, contaminated soil will be managed as solid wastes if it is handled, disposed or utilized in the following ways: (a) landfill; (b) incineration; (c) cement kiln co-processing; (d) used to produce construction materials, such as bricks, tiles and road materials, etc.

10. Another expert provided information on the leaching criteria in Australia and the European Commission.

11. It should be noted that a review of available information on thresholds for the identification of mercury wastes used by countries and regions is included in a report of an informal process lead by Japan on mercury waste threshold (UNEP/MC/COP.1/INF/10)⁵. Any update information in this regard would be helpful.

⁵ <http://www.mercuryconvention.org/Meetings/COP1/tabid/5544/language/en-US/Default.aspx>

E. Proposed threshold values

12. One expert provided information on threshold values used in Swedish waste and soil regulations, and suggested threshold values as summarised in Figure 4.

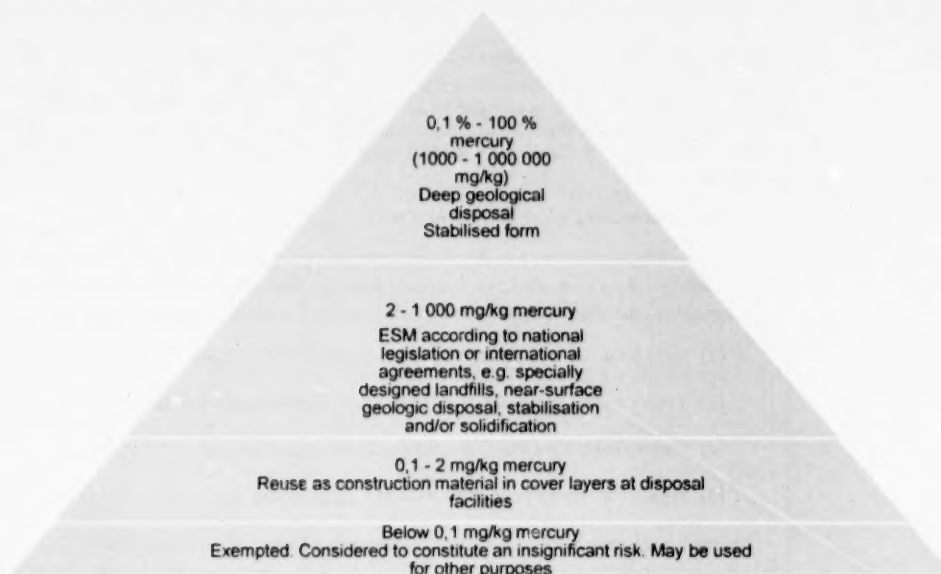


Figure 4: Suggested threshold values for mercury concentrations to be used when selecting ESM method for different mercury wastes.

Another expert proposed concentration limit is 25 mg of mercury or mercuric substances per kg of dry mass for solid product or waste, and 25 mg of mercury or mercuric substances per kg of liquid product or waste, based on the Global Harmonized System of chemical classification of substances. The same expert submitted an impact assessment of this proposed concentration limit.